The Actuarial Profession
making financial sense of the future

Recent developments in mortality

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Recent developments in mortality

- Patterns of aggregate mortality change
- Underlying causes
  - Heart disease
  - Lung cancer
  - Other cancers

Patterns of mortality change

Models fitted to ***aggregate*** mortality rates for the population of England & Wales show:

- The rate of improvement has varied by birth cohort
- The rate of improvement *within* birth cohorts has *accelerated* over time

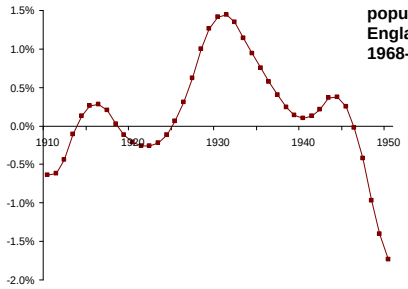
Patterns of mortality change

Throughout this presentation I will be referring to results generated by a model which splits mortality rate improvements into age, period & cohort elements, i.e.

Annual rate of improvement =
age component +
period component +
cohort component

'Cohort component' of aggregate mortality improvement model

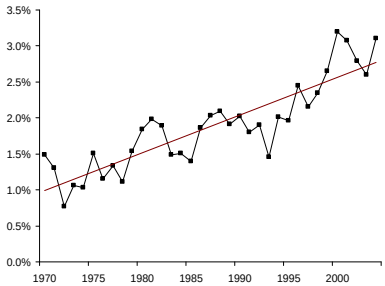
Derived using male population data for England & Wales, 1968-2004



Source data: ONS

'Period component' of aggregate mortality improvement model

Derived using male population data for England & Wales, 1968-2004



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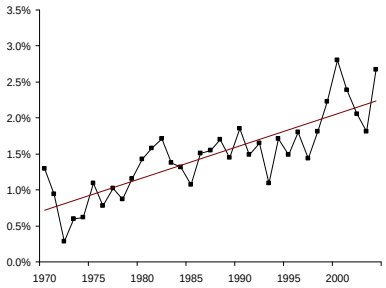
‘Period component’ of aggregate mortality improvement model



Derived using <u>female</u> population data for England & Wales, 1968-2004

Source data: ONS

Underlying causes

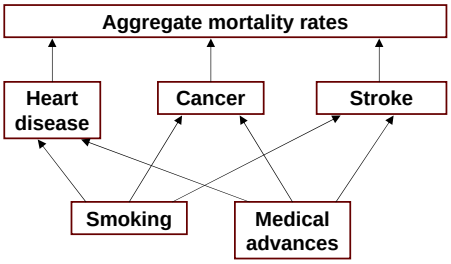
Aggregate mortality rates

Underlying causes

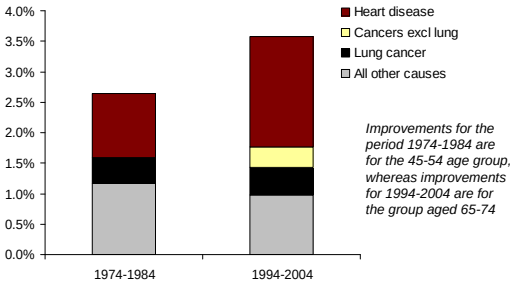
Aggregate mortality rates

Heart disease | **Cancer** | **Stroke**

Underlying causes



Average annual mortality improvement by cause of death, males in England & Wales



Improvements for the period 1974-1984 are for the 45-54 age group, whereas improvements for 1994-2004 are for the group aged 65-74

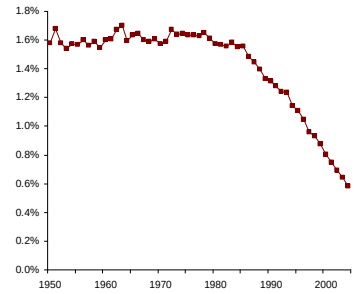
Source data: ONS

Mortality change by cause of death

- **Heart disease** improvements have become increasingly significant
- The relative importance of **lung cancer** improvements has reduced
- Mortality improvements in **other cancers** are beginning to emerge as a contributory factor

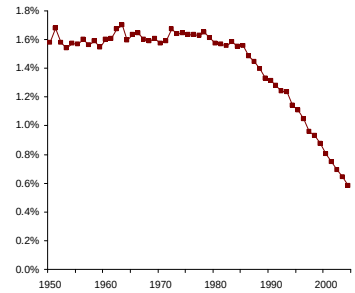
Heart disease

Mortality rate from heart disease, males in England & Wales, aged 65-74, 1950-2004



Source data: ONS

Mortality rate from heart disease, males in England & Wales, aged 65-74, 1950-2004

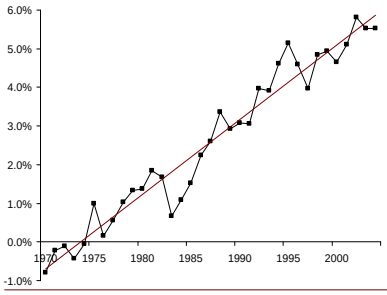


"Premature deaths from heart disease could be eliminated within 10 years "

Prof. Roger Boyle, 2004

Source data: ONS

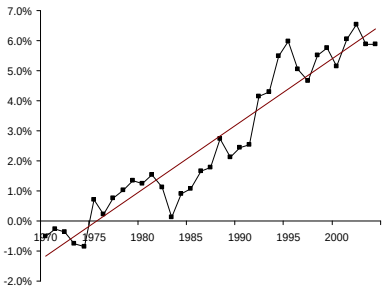
‘Period component’ of heart disease mortality improvement model



Derived using male population data for England & Wales, 1968-2004

Source data: ONS

‘Period component’ of heart disease mortality improvement model



Derived using female population data for England & Wales, 1968-2004

Source data: ONS

Explaining the Decline in Coronary Heart Disease Mortality in England and Wales Between 1981 and 2000, Unal *et al*, 2004

Treatment of acute myocardial infarction (MI)	8%
Secondary prevention after MI/surgery	11%
Treatment for angina	7%
Treatment for heart failure	13%
Other treatments	3%
Total heart disease treatments	**42%**
Smoking	48%
Population blood pressure	10%
Population cholesterol	10%
Deprivation	3%
Obesity	-3%
Physical activity	-4%
Diabetes	-5%
Total population risk factor changes	**58%**

Proportion of total decline in heart disease mortality explained by various factors

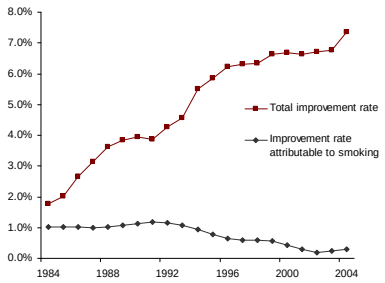
Increase in NHS prescriptions for selected treatments

NHS prescriptions (millions per annum), England

	1984	1994	2004
Beta-blockers	11.8	14.0	26.4
Anti-hypertensive therapy	4.6	9.7	38.6
Lipid regulating drugs (incl. statins)	0.2	1.7	29.4
All prescriptions for circulatory disease	**52.3**	**81.0**	**200.6**

Source: Department of Health, 2005

Annual rate of improvement in heart disease mortality for males aged 60-69, England & Wales



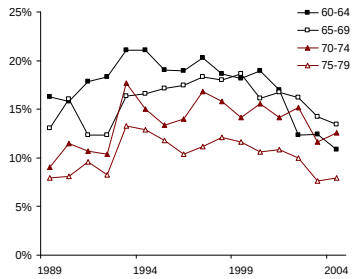
Improvements attributable to smoking are based on own model of the relative risk of smokers relative to non-smokers allowing for the reduction of relative risk for ex-smokers dependant on the period elapsed since quitting cigarettes. Source data: ONS, review of medical journals.

Some recent heart disease developments

- Wald & Law, 2003
  - A strategy to reduce cardiovascular mortality by 80%
- Health Development Agency (HDA), 2004
  - Changes necessary to reduce heart disease mortality by 50%
- National Institute of Health & Clinical Excellence (NICE), 2006
  - Widening of prescription guidelines for statins
- The ASTEROID trial, JAMA, 2006
  - Intensive therapy with statins can *reverse* atherosclerosis
- Baigent *et al*, 2005, Manuel *et al*, 2006, etc…
  - Increasing debate on best strategy for reducing heart disease

Lung cancer

Proportion of aggregate improvements due to reduced deaths from lung cancer

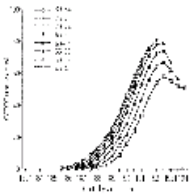


Proportion of total change in aggregate mortality over the previous 10 years due to the reduction in lung cancer mortality, males in England & Wales

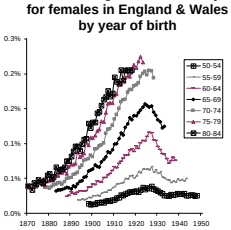
Source data: ONS

Lung cancer mortality is very strongly linked to lifetime cigarette consumption

Female cumulative constant tar cigarette consumption (CCTCC) by age and central year of birth, UK



Rate of lung cancer mortality for females in England & Wales by year of birth



Source data: ONS & Lee et al (1993)

Lung cancer improvements

- "…an almost perfect example of a cohort effect…"
  Health of Adult Britain, 1997
- The age, period, cohort model fitted to lung cancer mortality suggests that the pace of improvement within birth cohorts peaked around 1990-95
- Trends in lung cancer mortality are sometimes used as an indirect indicator for decomposing aggregate mortality trends into 'smoking-attributable' and 'non-smoking-attributable' elements
  See, for example, Peto, Lopez et al, 2004

Impact of smoking bans?

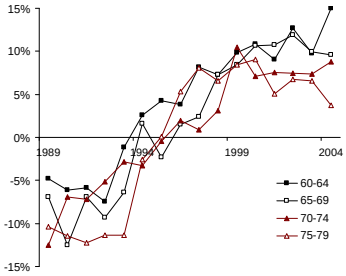
- Cigarette smoking prevalence is lowest at more advanced ages, e.g. only **8%** of people in England aged 75+ smoke cigarettes
- Epidemiological studies show the benefit of giving-up cigarette smoking reduces significantly with advancing age

e.g. Doll et al, 2004, suggest that a smoker aged 30 would gain approx ten years of life from giving-up smoking, but a smoker aged 60 would gain only three years

- The potential impact is far more significant for younger generations

Other cancers

Proportion of aggregate improvements due to reduced deaths from other cancers



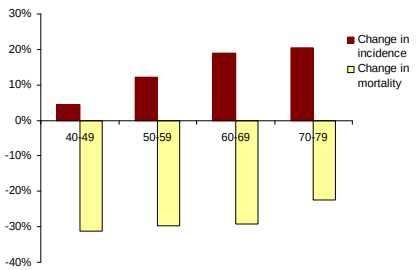
Proportion of total change in aggregate mortality over the previous 10 years due to the reduction in cancer mortality (excluding lung cancer), males in England & Wales

Source data: ONS

Other cancer improvements

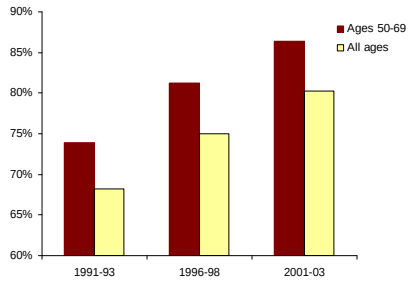
- Improvements mainly driven by medical advances
- In some cases recorded *incidence* rates have increased, whereas *mortality* rates have reduced

Change in female breast cancer incidence & mortality, 1992-2003, by age group



Source data: ONS

5 year survival rates from female breast cancer diagnosed 1991-2003, Eng & Wales



Source data: London School of Hygiene and Tropical Medicine, Office for National Statistics, 2005

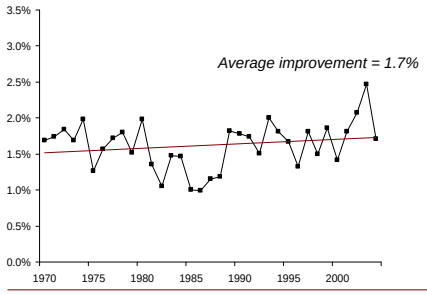
Other cancer improvements

- "Cancer will be as controllable as diabetes by 2050."
  Professor Gordon McVie
- "95% of cancers will be controllable by 2054"
  Professor Karol Sikora

Recent developments in mortality

- The relative importance of cigarette smoking as a driving force of mortality improvement *has* diminished
- However, this has *not* led to the [predicted] reduction in the aggregate pace of improvement
- Medical advances are playing an increasingly important role in driving mortality change

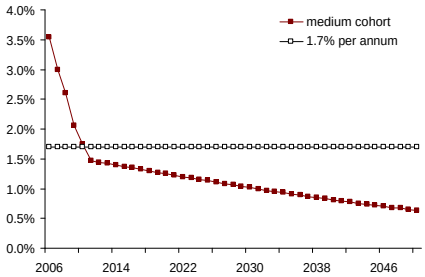
‘Period component’ of all-cause mortality (excl. heart disease) improvement model



Derived using <u>male</u> population data for England & Wales, 1968-2004

Source data: ONS

Projected improvements on ‘medium cohort’ basis for q_{75}



Personal view

In most instances mortality projections which generate future improvements **far below** long-term average rates (e.g. the ‘medium cohort’ basis) are not suitable for generating “best-estimate” assumptions for EV or FRS17/IAS19 reporting.

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